3-2010

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HHS Public Access

Author manuscript

Alcohol Clin Exp Res. Author manuscript; available in PMC 2015 June 16.

Published in final edited form as:

Alcohol Clin Exp Res. 2010 March 1; 34(3): 499–508. doi:10.1111/j.1530-0277.2009.01115.x.

Feasibility of Using Interactive Voice Response to Monitor Daily Drinking, Moods and Relationship Processes on a Daily Basis in Alcoholic Couples

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Abstract

Background—Daily process research on alcohol involvement has used paper-and-pencil and electronic data collection methods, but no studies have yet tested the feasibility of using Interactive Voice Response (IVR) technology to monitor drinking, affective, and social interactional processes among alcoholic (ALC) couples. This study tested the feasibility of using IVR with n=54 ALC couples.

Methods—Participants were n=54 couples (probands who met criteria for a past one-year alcohol use disorder and their partners) recruited from a substance abuse treatment center and the local community. Probands and their partners reported on their daily drinking, marital interactions, and moods once a day for 14 consecutive days using an IVR system. Probands and partners were on average 43.4 and 43.0 years old, respectively.

Results—Participants completed a total of 1,418 out of a possible 1,512 diary days for an overall compliance rate of 93.8%. ALC probands completed an average of 13.3 (1.0) diary reports, and partners completed an average of 13.2 (1.0) diary reports. On average, daily IVR calls lasted 7.8 (3.0) minutes for ALC probands and 7.6 (3.0) minutes for partners. Compliance was significant lower on weekend days (Fridays and Saturdays) compared to other weekdays for probands and spouses. Although today's intoxication predicted tomorrow's noncompliance for probands but not spouses, the strongest predictor of proband's compliance was their spouse's compliance. Daily anxiety and marital conflict were associated with daily IVR nonresponse, which triggered automated reminder calls.

Conclusions—Findings supported that IVR is a useful method for collecting daily drinking, mood, and relationship process data from alcoholic couples. Probands' compliance is strongly associated with their partners' compliance, and automated IVR calls may facilitate compliance on high anxiety, high conflict days.

Keywords

Daily process design; Interactive voice response (IVR); daily compliance; alcoholic couples

1. Introduction

Problem alcohol use and alcoholism are conceptualized as individual-level phenomena, yet numerous studies have documented reciprocal associations of alcohol involvement with variations in the marital relationship (Leonard & Eiden, 2007; Leonard & Rothbard, 1999; Marshal, 2003). For example, husbands' and wives' drinking predicted lower marital quality and increased marital instability over one year (Leonard & Roberts, 1998; see Marshal, 2003, for a review), and alcohol misuse shows strong and consistent associations with intimate partner violence (Fals-Stewart et al., 2005; see Leonard & Eiden, 2007, for a review). Amato and Rogers (1997) showed that problems due to drinking or drug use predicted marital dissolution (divorce or permanent separation) 12 years later, and findings from the National Comorbidity Survey also indicated that alcohol abuse and dependence predicted divorce (Kessler et al., 1998; also see Amato & Previti, 2003; Prescott & Kendler, 2001). The reciprocal nature of the relationship between alcohol involvement and marriage was highlighted by evidence for positive effects of spousal involvement in the context of alcoholism treatment (McCrady et al., 1986; O'Farrell & Fals-Stewart, 2003).

A long line of research has used real-time behavioral observation methods to identify the marital interaction processes that may link alcohol involvement and marital outcomes (Floyd et al., 2006; Jacob & Leonard, 1988; Murphy and O'Farrell, 1996). More recently, studies have used *daily process methods* to examine the dynamics of daily alcohol involvement and relationship processes (e.g., Fals-Stewart et al., 2005). Daily process designs typically involve asking participants to report on their thoughts, feelings, and behaviors on a daily basis (Bolger et al., 2003; Tennen et al., 2000, 2003). Daily process designs have several notable strengths. In brief, daily process methods: 1) allow for the study of behavioral processes in their natural context; 2) reduce retrospection error and bias by measuring behavior and experience close to their real time occurrence; 3) provide important descriptive data on the temporal course of everyday experience that can be of considerable theoretical and practical significance; 4) establish temporal precedence and allow for reliable assessment of change over time; and 5) enable researchers to address the within-person associations between variables of interest, and determine if these within-person relations differ as a function of between-persons individual differences (Bolger et al., 2003; Tennen et al., 2000, 2003).

Daily process methods have proven useful for the study of alcohol involvement and its correlates (e.g., Helzer et al., 2002; 2008; for reviews, see Armeli et al., 2005; Leigh, 2000; Tennen et al., 2003). For example, Fals-Stewart et al. (2005) used daily process methods to examine the associations between daily alcohol use, antisocial personality disorder (ASPD),

and male-to-female intimate partner violence. Until the mid-1990s, researchers relied on paper and pencil diaries to study daily alcohol involvement (e.g., Rohsenow, 1983; Uchalik, 1979). For example, Poikolainen and Karkkainen (1983) recruited a sample of 49 moderate-to-heavy drinking males and asked them to record their alcohol consumption every day for 12 weeks using pocket-sized diaries. However, the use of paper-and-pencil diaries has been criticized because of difficulties in assessing compliance with daily process protocols (Stone et al., 2002; cf. Green et al., 2004; Tennen et al., 2006). As a result, investigators have become increasingly concerned over the issue of verification of daily reports (see Tennen & Affleck, 2002), and some researchers have advocated for the use of electronic diaries that allow for verification of the date and time of diary reports.

Hand-held computers, wireless sensors, the internet, and the telephone have all been used as electronic data collection methods in daily process studies (Bolger et al., 2003; Shiffman et al., 2008). To our knowledge, the first series of studies that used interactive voice response (IVR) to study daily drinking behavior was conducted by Perrine and colleagues (Perrine et al., 1995; Mundt et al., 1995; Searles et al., 1995). In one study of 51 men, Mundt et al. used an IVR system to collect data on daily alcohol involvement for 112 days. Participants were asked to call a toll-free 800 number with a touch-tone telephone every day to complete various measures of alcohol involvement, mood, stress, and physical health over the preceding 24 hours.

Over the last several years, the use of IVR in daily process studies of alcohol involvement has increased. Kranzler et al. (2004) used daily process methods to study daily drinking behavior in a sample of heavy-drinking adults in a trial of daily versus targeted naltrexone. Participants called in to an automated IVR system every day for 84 days and reported on their daily drinking behaviors, daily moods, and medication adherence. However, to our knowledge, no studies have yet used IVR to examine daily processes among alcoholic couples (defined as couples where one or both partners has a past 1-year alcohol use disorder). High adherence is particularly important in research on dyadic processes because the effects of marital happiness on alcohol involvement vary as a function of time (McCrady et al., 2004). If data is missing for both members of the couple on the same days, and if these days are not random, we will be less likely to capture these time-varying effects. Similarly, if one member of the couple does not complete a daily report on a given day, couple-level data are unavailable on that day. Accordingly, the purpose of the present study was to test the feasibility of collecting daily process data from alcoholic couples using an IVR system.

2. Materials and Methods

2.1. Participants: Treatment Sample

As part of a larger study, alcoholic probands and their spouses were recruited from a local substance abuse treatment center (n=20 couples) and from the local community (n=34 couples). For the treatment center sample, we screened 559 medical charts of current and incoming patients. A total of n=73 patients (13.1%) of the sampling pool) met the following criteria and were thus eligible to participate in the study: 1) DSM-IV clinical diagnosis of past 1-year alcohol abuse or dependence, 2) currently married, 3) 18 years of age and older, and 4) not a threat to self or others. Among those who did not meet eligibility criteria, by far

the most common reason was “not currently married” (62% of the sampling pool; cf. Zucker et al., 2000). Other common reasons for ineligibility included 1) no past 1-year alcohol use disorder (AUD) diagnosis (9% of the sampling pool), and 2) did not enter treatment after the intake interview or left treatment prior to recruitment (11% of the sampling pool).

After receiving permission from the person’s primary therapist, probands who met eligibility criteria were approached at the treatment center, either before or after an individual or group therapy session, and project staff explained the nature of the study and distributed an informational study brochure to the patient. For those patients who met inclusion criteria and expressed interest in participating, an initial phone call was scheduled to further discuss the study with the patient and his/her spouse. Potential participants and their spouses were contacted by phone as soon as possible after the patient had been approached (usually within 1–2 days). During this initial phone call, we explained the study to potential participants and their spouses and addressed any questions about study participation. Couples who agreed to participate were then scheduled for the in-person baseline T1 interview. Of the n=73 eligible recruits, n=20 (27.4%) agreed to participate. Among those who did not participate, 38% took the study brochure but did not call back; 32% refused to participate (the most common reason was “too busy”); and 19% indicated that their spouse was unable or unwilling to participate.

2.2. Participants: Community Sample

Given the challenges of recruiting married alcoholic couples from treatment, we expanded recruitment to include alcoholic couples from the surrounding community. We used the same broad inclusion criteria described earlier, with the following exception: because resources prohibited the establishment of DSM-IV clinical diagnosis of past 1-year alcohol abuse or dependence, we use the Rapid Alcohol Problem Screen 4 (RAPS4; Cherpitel, 2002) to screen for past 1-year AUD. The RAPS4 is a 4-item screening instrument for alcohol use disorders that incorporates 2 items from the Alcohol Use Disorders Identification Test (AUDIT; Saunders et al., 1993) and 2 items from the TWEAK (an acronym for Tolerance, Worried, Eye-opener, Amnesia, and K/Cut down; Russell, 1994). Research showed that a positive response to 1 of the 4 items had good sensitivity and specificity for identifying those with AUDs (Cherpitel, 2000). We retained the criteria of **1)** currently married, **2)** 18 years of age and older, and **3)** not a threat to self or others. Upon contacting our offices, potentially eligible persons were immediately asked if they were a) married or living with someone for at least 6 months and b) over the age of 18. Those who met both criteria were then told about the nature of the study and the requirement that the spouse also participate. We then administered the RAPS4 by telephone.

A total of 307 persons responded to our recruitment efforts. Most of the community participants (88.2%) were recruited via newspaper and web-based advertisements. We were unable to administer the RAPS4 to 68% of potential participants: 56% left an initial phone or email message but did not respond to further contact attempts, 33% indicated that they were “not alcoholic” after hearing a description of the study, and the remaining number refused to participate for various reasons (e.g., partner uninterested). Of the n=98 who screened as eligible and completed the RAPS4, over half (67%) screened positive for a past

1-year AUD, and of those who screened positive, 34 (52%) completed the T1 interview. Reasons for nonparticipation among those who screened positive and initially agreed to participate included: unable to re-contact (n=14), partner unwilling to participate (n=5), refused/no reason given (n=4), and no transportation (n=3).

2.3. Final Sample

The final sample consisted of a total of n=54 couples (20 clinical couples and 34 community couples; 37 couples with an alcoholic male proband/female partner and 17 couples with an alcoholic female proband/male partner). Alcoholic probands and their partners were on average 43.4 (13.2) and 43.0 (14.0) years old, respectively. The majority of participants (75.9% probands, 74.1% partners) were white. For probands and partners, the modal level of education was “some college.” With respect to annual income, the median level category was $30,000 to $39,999 for probands and $20,000 to $29,999 for partners.

2.4. Procedures

At Time 1 (baseline), couples completed a series of self-report measures and an IVR training session at our research center. One week later at Time 2 (T2), couples began the daily process phase of the study. Alcoholic probands and their spouses separately called in to an automated IVR system every night between 5:00pm and 9:00pm for 14 consecutive nights and answered questions about 1) the previous night’s drinking behavior and marital interactions, and 2) today’s drinking behavior, marital interactions, and moods. Participants reported on their drinking behaviors and marital interactions for two time frames: 1) *last night after you completed the telephone interview*, and 2) *since you woke up today*.

Previous daily process studies of individual alcohol involvement have collected reports for as long as 2 years (Helzer et al., 2002), and daily process studies of alcoholic couples have collected data for as long as 15 months with good compliance (Fals-Stewart et al, 2005). We selected a 14-day period because, to our knowledge, this is the first study to use IVR to collect daily process data from alcoholic couples. The 14-day period allowed for the collection of enough data to discern daily and weekly patterns in the variables of interest without imposing undue burden on participating couples.

2.5. Measures

We were interested in assessing the within-person and between-persons predictors of compliance. Accordingly, we obtained within (i.e., daily) and between-persons (i.e., past one month) measures of moods, marital interactions, and alcohol involvement. All past one month measures were completed during the baseline interview, so that for each participant, these reports represented their moods and behaviors in the month prior to the baseline interview.

2.5.1. Past month and daily moods—We used an adapted 18-item version of the Profile of Mood States (POMS; McNair, Lorr, & Droppleman, 1992) to assess five *past one-month mood* variables: depressed mood (4 items), anxious mood (3 items), anger (3 items), fatigue (3 items), and positive affect (5 items). Participants used a 5-point scale (0 = *not at all* to 4 = *extremely*) to indicate the extent to which they experienced these moods during the

previous month. Cronbach's alphas for probands and spouses, respectively, were .93 and .85 for depressed mood; .86 and .76 for anxious mood; .87 and .79 for anger; .89 and .89 for fatigue; and .93 and .88 for positive affect. Scores for each mood scale were obtained by averaging the ratings of the relevant items.

The same 18 items were used to assess *daily moods*. Participants use the same 5-point scale (0 = *not at all* to 4 = *extremely*) to indicate the extent to which they experienced each mood *since you woke up today*. Daily scores for each mood were obtained by averaging the ratings of the relevant items. Methods outlined in Cranford et al. (2006) were used to calculate between- and within-subjects reliabilities for each scale. The between-subject reliability estimates are interpreted as the between-subjects reliabilities of the average of the items for one fixed day (R_{1F} in Cranford et al.). The within-subjects reliabilities are interpreted as the reliability of each scale for detecting systematic changes in moods within subjects over all diary days (R_C in Cranford et al.). For daily depressed mood, estimates of R_{1F} for probands and spouses, respectively, were .80 and .86; and estimates of R_C were .79 and .84. For daily anxious mood, estimates of R_{1F} for probands and spouses, respectively, were .76 and .79; and estimates of R_C were .71 and .74. For daily anger, estimates of R_{1F} for probands and spouses, respectively, were .67 and .79; and estimates of R_C were .78 and .83. For daily fatigue, estimates of R_{1F} for probands and spouses, respectively, were .87 and .85; and estimates of R_C were .86 and .81. For daily positive affect, estimates of R_{1F} for probands and spouses were both .86; and estimates of R_C were .81 and .80. There was no discernible pattern of systematic change in the reliability coefficients from week 1 to week 2 for either probands or spouses.

2.5.2. Past month and daily negative marital interactions—We used the 7-item Social Undermining Scale (SUND), a measure drawn from the work of Vinokur and colleagues (Vinokur et al., 1996), and three items from Schulz et al.'s (2004) Withdrawn Marital Behavior Scale to assess *past-month negative marital interactions.* Participants used a 5-point scale (0 = *not at all* to 4 = *about every day*) to indicate how frequently their spouse engaged in various negative behaviors (e.g., criticism) during the past one month. Cronbach's alphas for probands and spouses, respectively, were .93 and .90. Due to concerns over participant burden, we used only 5 of these 10 items to assess *daily negative marital interactions.* Participants responded to each item for two time frames: 1) *last night after you completed the telephone interview*, and 2) *since you woke up today*. Response options for the daily process items were 0 (*no*) and 1 (*yes*). An index of the total number of negative marital interactions for each day was computed by summing the items.

2.5.3. Past month and daily positive marital interactions—Nine items taken from Manne et al. (2004) and de Koning & Weiss (2002) were used to assess *past one month positive marital interactions* (e.g., spouse acceptance). Items asked about the spouse's behavior during the past one month, using the same response options as those for the negative marital interaction items, and scores were calculated as the mean of the item scores. Cronbach's alphas for probands and spouses, respectively, were .89 and .87. We used 5 of these 9 items to assess *daily positive marital interactions*, and the format and response options were the same as those for the daily negative marital interaction items. An index of

the total number of positive marital interactions for each day was computed by summing the items.

2.5.4. Past 1 month and daily alcohol involvement—At T1, we used three items to assess *past 1-month alcohol consumption* (NIAAA, 2003). We obtained measures of *1) number of days consumed one or more alcoholic beverages* (frequency), *2) usual number of drinks per drinking day* (quantity), and *3) frequency of binge drinking*, defined as consuming 5 drinks for men (4 for women) within a 2-hour period (NIAAA, 2004). In addition, the Short Inventory of Problems (SIP; Miller et al., 1995) was used to measure alcohol-related problems in the past 3 months. Participants used a 5-point scale (0 = *never* to 3 = *daily or almost daily*) to indicate how frequently they had experienced each alcohol-related problem during the past three months. Cronbach's alphas for probands and spouses, respectively, were .95 and .94.

Items asking about *daily alcohol involvement* were adapted from Helzer et al. (2002) and Kranzler et al. (2004) using the standard definitions of alcoholic beverages (NIAAA, 2003). Also, following Kranzler et al., for each IVR report participants reported on their alcohol involvement for two time periods: 1) since waking up today, and 2) after completing last night's IVR report. For each time period, participants were asked to indicate how many 12 ounce cans or bottles of beer, drinks of wine, and standard drinks of hard liquor they had consumed. Variables for *number of drinks since waking up today* and *number of drinks after completing the IVR tonight* were calculated by summing responses across the three beverage types. We also calculated a variable for *total number of drinks today* by summing the values for "today's drinks" and "tonight's drinks." In order to assess *daily binge drinking* for the two time periods, participants were asked if they had consumed [5 or more drinks for males/4 or more drinks for females] within a 2 hour period (since waking up today and after completing last night's IVR). Response options for the binge drinking items were 0 (*no*) and 1 (*yes*).

In addition to these daily drinking measures, we also included six items about daily alcohol involvement from Searles et al. (1995; also see Helzer et al., 2002). For both time periods (i.e., since waking up today, and after completing last night's IVR report), participants were asked to indicate their a) *urge to drink* (0=*no urge to drink* and 10=*the strongest urge ever to drink*), *highest level of intoxication* (0=*perfectly sober* and 10=*as drunk as you've ever been*), *hangover* (0=*no hangover* and 10=*worst hangover you have ever had*), the *severity of any drinking-related problems* (0=*no problems* and 10=*extremely serious problems*), and the *location where they drank*. Finally, the last IVR question asked participants to indicate *how intoxicated do you feel right now?* (0=*perfectly sober* and 10=*as drunk as you've ever been*). As these six variables were positively skewed, we created binary versions of each variable. All participants responded to the same number of questions regardless of whether or not they reported drinking on that day.

2.6. IVR Training Session

Following completion of the marital interaction task, the project psychologist introduced Phase 2 of the pilot study, which involved completion of the *daily process measures* every

day for 14 consecutive days using the automated *Interactive Voice Response (IVR)* system. The IVR protocol for the current study was modeled after procedures described in Kranzler et al. (2004), which was the first application of IVR in an alcohol treatment study. Couples completed an extensive IVR training session immediately following the marital interaction task. Following the IVR training session, couples were compensated $50.00 for completing the marital interaction task and the IVR training session, and were provided with a study brochure with contact numbers for study staff in the event of questions or concerns. The day before the couple was scheduled to begin calling in to the IVR system, the project research assistant placed a reminder call to each couple and asked if there were any questions or concerns. Compliance with the IVR protocol was monitored daily by project staff and participants were called if they missed 2 consecutive IVR days, as recommended by Abu-Hasaballah et al. (2007). Dates and times of all calls into the IVR system were recorded electronically, allowing for assessment of compliance with diary protocols (Stone & Shiffman, 2002). Participants called a dedicated toll-free telephone number during the designated time window (5:00pm to 9:00pm) and responded to survey questions using the telephone keypad. Participants were asked to call separately when they had 15 minutes of privacy and were instructed not to discuss their responses with each other. Following completion of the 14-day IVR protocol, couples were compensated $100 ($50.00 per partner, approximately $3.60 per call). Incentives were prorated such that participants were compensated only for completed calls. A description of IVR and a summary of best practices are given in Abu-Hasaballah et al. (2007).[1]

2.7. Comparisons between Clinical and Community Samples

Comparisons between the probands and their partners from the clinical and community samples showed that clinical probands (M=5.7, SD=2.1) had a significantly higher income level than community probands (M=2.9, SD=2.0), $t(48)=4.7$, $p<.01$ and significantly lower levels of past month positive affect (M=1.6, SD=1.0) than community probands (M=2.2, SD=0.8), $t(52)= -2.3$, $p<.05$. The two groups did not differ on any of the other past month mood variables, all ps >.10. There were no group differences in frequency of past month negative or positive marital interactions. In addition, there were no significant group differences in number of drinking days, number of drinks per drinking day, or number of binge drinking days in the past year. However, community probands reported a significantly higher number of drinking days in the past one month (M=15.0, SD=9.7) than clinical probands (M=2.5, SD=5.4), $t(52)= -5.3$, $p<.01$. Community probands also reported more drinks per drinking day in the past one month (M=4.2, SD=4.5) than clinical probands (M=1.8, SD=4.6), and this difference approached statistical significance, $t(52)= -1.9$, $p=.07$. By contrast, clinical probands reported more frequent alcohol-related problems (M=18.6, SD=11.7) than community probands (M=10.4, SD=10.5), $t(52)= 2.7$, $p<.05$. Accordingly, we statistically controlled for recruitment source in all analyses.

[1]Additional details on the recruitment procedures are available from the first author.

3. Results

3.1. Compliance with IVR Protocol

Participants completed a total of 1,418 out of a possible 1,512 (54 × 2 × 14) = daily process reports, for an overall compliance rate of 93.8%. Using procedures for analyzing dyadic data outlined in Kenny et al. (2006), we tested for differences in dependent proportions using the McNemar test. Compliance was slightly higher among probands (94.3%) compared to spouses (93.3%), but this difference was not significant, $z = 1.30$. Participants completed an average of 13.1 (SD=1.1) out of a possible 14 IVR days (range=9–14 days, median=13 days, mode=14 days). About half of the sample (n=51, 47.2%) completed all 14 daily IVR reports. Compliance did not vary by recruitment source.

3.1.1. Day-Level Correlates of Noncompliance—For each IVR day, we computed two binary variables: one indicating if today's IVR call was completed, and one indicating if tomorrow's IVR call was completed (both coded 0=Yes, 1=No). We estimated generalized linear mixed models (GLMMs; Raudenbush & Bryk, 2002) of today's and tomorrow's noncompliance using the GLIMMIX procedure in SAS (SAS, 2008). All GLMMs used a Bernoulli sampling model at level-1 with a logit link. The log odds of noncompliance were then linked to day-level predictors in a level-1 structural model that took the form of a logistic regression model (Agresti, 1996). Separate GLMMs for probands and spouses were estimated.

For probands and spouses, there was no significant association between day in the study and today's noncompliance. However, results showed that the odds of today's noncompliance were significantly higher on Fridays and Saturdays compared to other weekdays for probands (OR=2.6, 95% CI=1.4 – 4.8) and spouses (OR=2.0, 95% CI=1.1 – 3.6). These results did not vary by recruitment source (clinical vs. community). Results for tomorrow's noncompliance, which are presented in Table 1, showed that a) none of today's five daily moods predicted tomorrow's noncompliance for probands or spouses; and b) total number of today's negative and positive interactions did not predict tomorrow's noncompliance for probands or spouses. We also examined the effects of today's alcohol involvement on tomorrow's noncompliance for probands and spouses, limiting analyses to those who reported drinking on at least 1 of the 14 IVR days. Results from GLMMs showed that a) total drinks consumed today, b) today's urge to drink, c) today's alcohol-related problems, and d) today's hangover did not predict tomorrow's noncompliance for probands or spouses. However, as seen in Table 1, today's intoxication predicted higher odds of tomorrow's noncompliance for probands but not for spouses.

3.1.2. Person-Level Correlates of Noncompliance—In order to examine person-level predictors of noncompliance, we calculated a binary variable for each participant indicating if they had missed *any* of the IVR days. We used a binary version of the "number of missed IVR days" variable because it showed a severe positive skew (94.7% of participants missed 3 or fewer days). Bivariate and multiple logistic regression analyses were used to test for between-persons correlates of noncompliance for probands and spouses. As seen in Table 1, education level, gender, age, income, and years married did not

predict noncompliance for probands or spouses. Trait-level measures of moods, past month negative and positive marital interactions, and marital satisfaction were all unrelated to noncompliance. Further, there were no statistically significant relationships between noncompliance and past 1-month alcohol or other substance use.

3.1.3. Dyad-Level Correlates of Compliance—Procedures described by Kenny et al. (2006) were used to examine the association between proband and spouse compliance across all IVR days. Dyads were distinguishable by proband status, and Cohen's kappa (Cohen, 1960) was used to test the hypothesis of nonindependence of proband and spouse daily compliance. Results showed that there was a strong association between proband and spouse daily compliance, $\kappa = .57$, $p<.01$. This effect was very similar for male ($\kappa = .60$) and female ($\kappa = .53$) probands. The probability of proband compliance on a given IVR day was about .95. On days when the spouse completed the IVR, the probability of probands' compliance increased to about .98. By contrast, on days when the spouse did not complete the IVR, the probability of probands' compliance decreased to about .45.

3.2. Time to Complete IVR Calls

The final IVR questionnaire included 48 separate items asking about daily moods, marital interactions, and drinking behaviors. On average, IVR calls took 7.5 (2.9) minutes. IVR call time decreased as number of days in the study increased for both probands ($r= -.44$, $p<.01$) and spouses ($r = -.44$, $p<.01$). For example, on the 1st IVR day, the average call time was 11.8 (2.9) minutes. By IVR day 7, the average call time dropped to 6.9 (2.4) minutes, and by the final IVR day, the average call time dropped to 6.3 (2.5) minutes. Average length of the IVR call was moderately correlated with age for probands ($r= .30$, $p<.05$) and spouses ($r= .33$, $p<.05$), but was not associated with sex, income, education, number of hours worked in the previous week, or number of children in the home. Further, there were no associations between average length of the IVR call and 1) trait-level measures of moods, 2) past month negative and positive marital interactions, 3) marital satisfaction, 4) frequency and quantity of past 1 month alcohol use, 5) alcohol-related problems, or 6) past 1 month cigarette, marijuana, or cocaine use.

3.3. Automated Reminder Calls

Automated reminder calls were made by the IVR system on 148 days where either the proband or spouse had not called by 8:00pm and resulted in completed calls on 54 days (36.5%). Spouses completed a higher percentage of daily reports after receiving reminder calls (n=34, 4.8% of all completed calls) than probands (n=20, 2.8% of all completed calls), but this difference was not significant, $z = 1.91$. Probands reported more negative marital interactions on days that required a reminder call (M=2.7) than on days that did not require a reminder call (M=1.4), $t(628)=2.6$, $p<.01$, Cohen's $d = .54$. Further, probands reported higher levels of anxiety on days that required a reminder call (M=1.4) than on days that did not require a reminder call (M=0.9), $t(711)=2.4$, $p<.05$, Cohen's $d = .52$. Among spouses, days that did versus those that did not require a reminder call were also characterized by more negative marital interactions (M=2.5 vs. M=1.6, $t(613)=2.1$, $p<.05$, Cohen's $d = .37$) and fewer positive marital interactions (M=5.9 vs. M=7.0, $t(613)=2.0$, $p<.05$, Cohen's $d = -.$

36.). There were no differences between days that did and did not require a reminder call on any measure of alcohol involvement.

4. Discussion

The purpose of the present study was to test the feasibility of collecting daily drinking, mood, and marital interaction data from alcoholic couples using an IVR system. Previous work using IVR technology to study alcohol involvement has reported good compliance rates (e.g., Helzer et al., 2002; Searles et al., 1995, 2000), even among participants with alcohol use disorders (Simpson et al., 2005; Tucker et al., 2007). Several studies used daily process methods to collect data from alcoholic couples (Fals-Stewart et al., 2005) and couples with male social drinkers (Perrine et al., 1995). For example, Perrine et al. used IVR to collect daily process data from a sample of 30 male social drinkers for 28 days. Perrine et al. also asked participants' partners to report on the participant's daily alcohol consumption by calling in to a voice-mail answering service. However, to our knowledge the current study is the first to use IVR technology to collect data from both partners in alcoholic couples. Our results showed that daily compliance exceeded 90% for probands and their spouses. Previous research using daily process methods has emphasized the importance of extensive training sessions (e.g., Mundt et al., 1995), and this appears to have facilitated couples' compliance with the study protocol.

Several predictors of daily compliance were observed. Lower compliance on the first IVR day may have been due to the 1-week interval between the T1 interview and the start of the IVR protocol. Although this interval was selected in order to minimize possible carry-over effects of the T1 marital interaction task on the IVR reports, future research could formally test this hypothesis and/or select a shorter interval (see Merrilees et al., 2008). Lower compliance on Fridays and Saturdays was also observed, which may have been due to the higher levels of alcohol consumption on weekends. Also, departure from normal routines on weekends may have increased the likelihood that participants would forget to call. IVR training sessions could 1) emphasize the importance of completing IVR reports on weekend days and 2) consider using an expanded time window to enhance compliance.

Given that several daily process studies of alcohol involvement have focused on moods and/or marital interactions (Fals-Stewart et al., 2005; Kranzler et al., 2004), it is encouraging that none of these variables predicted noncompliance, either at the between- or within-persons levels. However, we found that today's intoxication predicted tomorrow's noncompliance among probands (but not spouses). Litt et al. (1998) also found some evidence that alcohol consumption has a negative effect on daily compliance in their ecological momentary assessment (EMA) study of 27 alcohol-dependent men. Litt et al. found that almost half of their participants who reported drinking during the study period showed deteriorations in compliance on subsequent days. One possible solution to this problem is to closely monitor participants' reports of intoxication and initiate personal reminder calls on subsequent days. We emphasize, however, that none of the other measures of alcohol involvement predicted noncompliance.

The strongest predictor of noncompliance was the spouse's noncompliance. This finding is consistent with research on Behavioral Couples Therapy (BCT) for alcohol use disorders. For example, McCrady et al. (1986) found that greater spousal involvement in alcohol treatment was associated with higher treatment compliance (i.e., more treatment sessions and a higher proportion of completed conjoint homework assignments). However, given that daily marital interactions were not predictive of noncompliance, the association between proband and spouse compliance may have been driven by couples' shared activities during the evening that conflicted with the IVR time window. This finding highlights the importance of emphasizing both partners' compliance during the IVR training session.

Automated reminder calls were useful for collecting data from probands and spouses alike. Kranzler et al. (2004) also found evidence for the effectiveness of automated reminder calls in an IVR study of heavy drinkers, and Corkrey and Parkinson (2002) reviewed several studies showing that automated IVR calls increased appointment rates and treatment compliance (also see Abu-Hasaballah et al., 2007). Our results showed that higher levels of anxiety and marital conflict were associated with failure to call the IVR system within the designated time window, which in turn triggered the automated reminder calls. Although these findings suggest that automated reminder calls might be useful for enhancing compliance on days characterized by higher levels of anxiety and marital conflict, we were not able to directly test this hypothesis. Yet, given the relatively high levels of negative marital interactions among alcoholic couples (Fals-Stewart et al., 2005; Floyd et al., 2006) and the elevated rates of anxiety disorders among alcoholic probands and their relatives (Schuckit et al., 1997), these results demonstrate the value of automated reminder calls to study moods and marital dynamics in this population.

Limitations and Strengths

Results from this research should be considered in the context of several limitations and strengths. We used a small convenience sample that included probands currently in alcohol treatment and community probands not in treatment. Community probands met screening criteria for a past 1-year alcohol use disorder, but in the absence of clinical assessment we were not able to confirm participants' clinical status. Also, participation rates for both groups were relatively low, and the extent of nonresponse bias is unknown. In addition, while reports on today's and last night's drinking behaviors and marital interactions were relatively close to the real-time occurrence of daily behaviors, they still allow room for retrospection biases (see Stone et al., 1998; Tennen et al., 2000). Also, it is possible that some partners may have completed the IVR reports for their spouses. To minimize this possibility, we explicitly instructed participants to call the IVR system separately when they had 10–15 minutes of privacy. Also, each partner was given a unique identification number to log-in to the IVR system. Further, during the IVR training session, each partner was asked to log-in to the IVR system using their own identification number and complete at least 5 sample items from the daily diary questionnaire. Despite these precautions, we acknowledge that it is impossible to determine if spouses completed their partners' IVR reports.

Several strengths of the present study are noteworthy. To our knowledge, this is the first study to use IVR to collect daily process data from both partners in alcoholic couples. As

noted earlier, compliance takes on added importance in research on couples because data from both partners are needed to model dyadic processes (e.g., Dunn et al., 1987). Although our sample was diverse, we were able to demonstrate that IVR can be used to collect daily drinking, mood, and marital interaction data from alcoholic couples with good compliance. Verification of the date and time of daily reports is also an important concern in daily process research (Stone & Shiffman, 2002), and by using IVR to collect daily process data we were able to confirm the dates and times of all IVR calls. Also, our design allowed us to identify between- and within-persons predictors of daily compliance and to test for dyadic effects on compliance.

Future Directions and Implications

Findings suggest several directions for further research. Identifying methods for detecting fraudulent reporting (i.e., partners completing each other's IVR reports) is a research priority. In order to maximize the probability that probands and partners would complete only their own (and not their partner's) IVR reports, we used written and verbal instructions, unique identification numbers for each proband and partner to log-in to the IVR system, and intensive training sessions. In addition to these methods, some form of voice recording may be the optimal way to detect fraudulent reporting. Also, in the current study, probands and partners reported on their own moods and behaviors, and future research can benefit by obtaining collateral reports of probands' alcohol involvement (cf. Dunn et al., 1992; Perrine et al., 1995). In addition, the relatively high compliance rates among couples in the present study suggest that IVR might be useful for collecting daily process data from other family members, including children. Recent work demonstrated the feasibility of using IVR technology to collect data from children as young as age 9 (Stritzke et al., 2005), and using IVR to collect daily process data from children living in alcoholic families would be a logical next step. Finally, for some phenomena (e.g., moods), ecological momentary assessment (EMA) involving multiple assessments within days may be needed to capture the dynamic processes of alcohol involvement and its correlates with adequate temporal resolution (Shiffman et al., 2008). Collins et al. (2003) demonstrated the feasibility of collecting EMA data on alcohol involvement using cellular phones with an IVR system, and this represents a promising direction for research on alcohol involvement in couples.

Daily process methods have been used to study relationship processes in nonalcoholic (Rafaeli et al., 2008) and alcoholic couples (Fals-Stewart et al., 2005). To our knowledge, this is the first study to use IVR technology to collect daily process data from alcoholic couples, and findings indicated that IVR is feasible and yields good compliance with a once-daily protocol. The potential significance of the current study is directly tied to the observation that risk and protective factors for alcohol problems are dynamic processes that operate in real time and across developmental and socio-historical time (Zucker, 1994). As noted earlier, a substantial body of research using behavioral observation methods has identified some of the real-time marital interactions that characterize alcoholic couples (e.g., Floyd et al., 2006; Jacob & Leonard, 1988). In addition, several long-term prospective longitudinal studies following participants for up to 40 years have advanced our understanding of longer-term trajectories of alcohol involvement (see Zucker, 2008). At the same time, social psychological influences on developmental course and outcome are poorly

specified in current typologies of alcoholism (Zucker et al., 1995). Daily process studies can yield invaluable evidence for the linkages between real-time and developmental time processes and our results indicate that IVR technology can be used to better specify the marital context of alcohol use disorders.

We provide two examples of how daily process methods and IVR technology can advance research on marital interactions and alcohol involvement. First, real time characterization of marital interactions is critical to the understanding of marital processes at a micro-level. At the moment, our science is constrained by the fact that such data are usually collected in the artificial setting of the laboratory, with its potential to suppress extremes of behavior (e.g., Caplan et al., 1998; cf. Heyman, 2001). Furthermore, the constraints of controlled laboratory observation limit the extent of sampling and observation of sequencing that can occur. These constraints make it difficult to discern the temporal direction of the association between marital interactions and alcohol involvement, which sometimes emerge over several days (Dunn et al., 1987). Daily process methods coupled with IVR technology can sample interactions sequentially over extended periods of time and have the potential to clarify the temporal direction of the reciprocal associations between marital behaviors and alcohol involvement.

Second, research showed that alcohol behavioral couples therapy reduced alcohol involvement among males and females with AUDs (McCrady et al., 2009; O'Farrell & Fals-Stewart, 2003). However, the mechanisms for the beneficial effects of couple-level interventions are not known. Collecting valid and reliable data on marital interactions from both partners is essential to the success of this work, yet self and collateral reports are by their nature distorted both by the time since an interaction took place and by their coloring of it over time. The utilization of daily IVR assessments would reduce these confounds and sources of error and could clarify the mechanisms underlying the beneficial effects of couple-level interventions.

Acknowledgments

This research was supported by National Institute on Alcohol Abuse and Alcoholism (NIAAA) Grant R21 AA015105. We thank Janie Slayden, Jenna Johnson, Ann Mooney, and the staff, clinicians, and director of the University of Michigan Addiction Treatment Services (UMATS) for their assistance with this research.

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Table 1

Day- and Person-Level Correlates of Tomorrow's Noncompliance

	Proband noncompliance (*n* = 54)	Partner noncompliance (*n* = 54)
	OR (95% CI)	**OR (95% CI)**
Day-level correlates		
Today's moods		
Depressed mood	1.3 (0.6–2.8)	0.8 (0.4–1.6)
Anxious mood	0.6 (0.3–1.3)	0.9 (0.5–1.6)
Anger	1.6 (0.9–2.9)	1.3 (0.8–2.1)
Fatigue	0.7 (0.5–1.1)	1.2 (0.8–1.8)
Positive affect	1.0 (0.6–1.6)	1.3 (0.8–2.1)
Today's marital interactions		
Negative interactions	0.9 (0.6–1.2)	1.1 (0.8–1.4)
Positive interactions	0.9 (0.7–1.2)	1.1 (0.9–1.4)
Today's alcohol involvement[a]		
Total drinks	1.1 (0.9–1.3)	1.1 (0.8–1.5)
Any binge drinking	1.7 (0.2–14.1)	NA
Any urge to drink	0.7 (0.3–1.6)	0.9 (0.4–2.0)
Any intoxication	3.0* (1.1–8.3)	1.2 (0.2–5.4)
Any hangover	0.9 (0.2–3.4)	NA
Any alcohol-related problems	1.8 (0.5–5.9)	NA
Person-level correlates		
Demographics		
Gender (1 = male)	1.2 (0.4–3.7)	1.2 (0.4–3.8)
Age	0.96 (0.91–1.003)	0.96 (0.92–1.01)
Education	0.8 (0.5–1.4)	1.9 (0.9–3.8)
Race (1 = non-white)	1.2 (0.3–4.3)	3.0 (0.7–12.7)
Years married	0.97 (0.92–1.02)	0.98 (0.93–1.03)
Marital satisfaction	0.7 (0.4–1.6)	1.2 (0.6–2.6)
Past 1-month moods		
Depressed mood	0.4 (0.1–1.4)	1.1 (0.4–3.0)
Anxious mood	0.8 (0.2–2.7)	1.0 (0.4–2.4)
Anger	1.6 (0.7–3.7)	0.8 (0.3–1.9)
Fatigue	1.2 (0.5–2.9)	1.1 (0.6–2.4)
Positive affect	0.4 (0.2–1.1)	0.9 (0.4–2.1)
Past 1-month marital interactions		
Negative interactions	1.1 (0.6–2.1)	0.8 (0.4–1.8)
Positive interactions	1.3 (0.7–2.6)	0.7 (0.3–1.6)
Past 1-month alcohol use[b]		
Frequency of drinking	0.9 (0.8–1.01)	1.0 (0.9–1.04)
Quantity of drinking	1.1 (0.9–1.4)	0.8 (0.5–1.3)
Binge drinking days	0.8 (0.7–1.04)	1.2 (0.8–1.7)

	Proband noncompliance (*n* = 54)	**Partner noncompliance (*n* = 54)**
	OR (95% CI)	**OR (95% CI)**
Alcohol-related problems	1.02 (0.9–1.1)	1.03 (0.9–1.2)
Past 1-month substance use		
Any marijuana use (1 = yes)	0.5 (0.04–6.5)	1.2 (0.9–1.2)
Any cocaine use (1 = yes)	1.0 (0.3–3.7)	0.8 (0.2–3.2)